

REMARKS

Claims 1 and 2 have been examined. Claims 3 and 4 were previously withdrawn from consideration.

Claims 1 and 2 were objected to for various informalities pointed out by the Examiner. Claims 1 and 2 are amended to correct these informalities.

Claims 1 and 2 were rejected under 35 U.S.C. §112, second paragraph, for indefiniteness. Claim 1 requires that a component of the catalytic-activity constituent (which will form the catalytic-activity particles) is Ni and/or Co. Claim 2 is amended to clarify that the catalytic-activity particles are composed of elemental Ni and/or Co and/or compounds of Ni or Co. Claim 2 further defines the catalyst of Claim 1 and withdrawal of the rejection under 35 U.S.C. § 112 and objections to claims 1 and 2 are requested.

Claims 1 and 2 were rejected under 35 U.S.C. § 102(b)/103(a) as anticipated by, or in the alternative, as obvious over U.S. Patent 3,998,758 to Clyde et al. Applicants traverse this rejection for the following reasons.

The catalyst of the present invention includes a complex oxide formed on a surface (including the inner surface) of a porous carrier body and catalytic-activity particles produced by activation of the complex oxide. The complex oxide originates from coprecipitates deposited on the surface of the porous carrier body and therefore has a homogeneous composition (or a "solid solution") on a molecular scale. The catalytic activity particles, produced by activation of these complex oxides (in a homogeneous composition), are uniformly distributed as nanoparticles on the surface of the porous carrier body including its inner surface.

Such a catalyst with high dispersion of the catalytic nanoparticles as in the present invention is particularly effective for reforming reactions without degradation of activity, as explained in the specification on page 5, lines 5-16. The high dispersion is achieved by simultaneous impregnation of the catalytic-activity constituent and carrier-forming constituent into the porous carrier body with the resultant dispersion of the catalytic nanoparticles being limited to a surface (including the inner surface) region of the porous carrier body. Therefore, the catalytic nanoparticles can be efficiently and effectively used in hydrocarbon-reforming reactions without degradation of activity. These effects are not achieved by the catalyst of Clyde. Moreover, the catalyst of Clyde lacks the claimed nanoparticles, and there is no suggestion in the patent to produce the claimed nanoparticles.

The catalyst of Clyde has a porous ceramic support coated with first and second layers of Ni, Cu or Co. The second layer is co-deposited with Al, Mg or Zn. The first layer is applied by vapor deposition to 0.10 – 0.30 mm thick (column 3, line 35) and the second layer is similarly applied yielding a network-forming element (Ni, Cu or Co) co-deposited with Al, Mg or Zn. These layers are heated at 500-700° C in a hydrogen atmosphere so as to fuse the co-deposited metals together (column 3, lines 47-49), and then subjected to alkaline or acidic treatment for partially leaching of the Al, Mg or Zn. This leaching out of the Al, Mg or Zn from the second layer produces a lattice network in the second layer. The catalyst is regenerated by leaching out additional metal (column 3, lines 65-66) so as to expose a fresh surface. The exposure of the fresh surface does not generate catalytic nanoparticles.

The Examiner apparently equates the distribution of Al, Mg or Zn in a lattice network of Ni, Cu or Co of Clyde with the claimed dispersion of nanoparticles. However, a lattice network is not a dispersion of particles. Clyde does not suggest the structure of the present invention of nanoparticles distributed on a support. Instead, Clyde only teaches producing a lattice network of metals on a support. Nothing in Clyde suggests producing nanoparticles, and the Examiner has not addressed that feature of claim 1. Furthermore, Clyde describes the first and second layers having total thickness of 0.2-0.6 mm, while the catalytic nanoparticles of the invention are of 3.5 nm or less in size. The layers of Clyde are two orders of magnitude greater than the nanoparticles claimed. This large difference in scale demonstrates that the presence of nanoparticles is not taught or suggested by Clyde. This absence of nanoparticles is further supported by the teaching in Clyde to regenerate with alkaline or acidic treatment whereby Al, Mg or Zn is partially leached out but does not generate nanoparticles. Therefore, the deposition of a layer of metal in Clyde with subsequent partial leaching thereof does not teach or suggest the highly dispersed nanoparticles of the claimed invention.

In addition, the process of producing a catalyst per Clyde cannot result in the claimed catalyst. The vapor deposited layers of Clyde are metals with lower affinity to the porous support, compared with the complex oxide of the invention. In contrast, the complex oxide of the invention is formed by co-precipitating both the catalytic-activity and carrier-forming constituents on a surface of the porous carrier body and calcining the porous body impregnated with the catalytic-activity and the carrier-forming constituents. The vapor

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deposition process used to produce first and second layers onto inner surfaces of the porous support requires complicated equipment (e.g. vacuum chamber) and is unlikely to result in uniform deposition on an inner surface of the porous support due to inner walls acting as obstacles for traveling of vapors. Additionally, when Al, Mg or Zn is partially leached out from the second layer by treatment with an alkali or acid, the catalytic activity of Ni, Cu or Co is often degraded.

In short, Clyde does not teach or suggest a catalyst comprising dispersion of nanoparticles on a support as required by claim 1. Claim 1 has been amended to more clearly recite these features of the present invention. Support therefor appears at least at page 5 and throughout the specification. No new matter has been added.

Reconsideration of the rejections and allowance of claims 1 and 2 are respectfully requested.

In view of the foregoing amendments and remarks, it is urged this case is now in condition for allowance.

Respectfully submitted,

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